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OFFICE OF
ECOSYSTEMS,
TRIBAL AND PUBLIC
AFFAIRS

March 26, 2013

Richard Turner
Project Manager
US Army Corps of Engineers
Walla Walla District
201 North Third Avenue
Walla Walla, WA 99362

Re: The Environmental Protection Agency's comments on the Lower Snake River Programmatic Sediment Management Plan Draft EIS. EPA Project Number 05-055-COE.

Dear Mr. Turner:

The EPA has reviewed the Corps of Engineers' DEIS for the **Lower Snake River PSMP** encompassing the states of Idaho, Oregon, and Washington. Our comments are provided in accordance with our responsibilities and authorities under Section 309 of the Clean Air Act and the National Environmental Policy Act. After conducting our review, the EPA has rated the DEIS EO-2 (Environmental Objection-Insufficient Information). An explanation of this rating is enclosed.

The purpose of the DEIS is to evaluate a long-term sediment management strategy for the Lower Snake River by employing a comprehensive watershed approach. The project area covers more than 32,000 square miles and includes the Snake River from the confluence with the Columbia River to the upstream limits of the Lower Granite Reservoir. The DEIS evaluates a no action alternative (continued monitoring) and two action alternatives- Alternative 5 (dredging based management) and Alternative 7 (full system and sediment management measures). The action alternatives also include a specific proposal to dredge in 2013/2014. The DEIS identifies Alternative 7 as the Corps' preferred alternative.

The EPA supports the approach to conduct a watershed scale analysis of sediment sources. We commend the Corps for collaborating with the various agencies and research entities to characterize sediment in the Lower Snake River basin. The studies presented in the DEIS and appendices are of a high quality and are the result of a considerable effort.

However, we believe that the DEIS does not carry forward management measures that advance this work or long-term sediment reduction. We believe that significant uncertainties in the interpretations of sediment sources in the DEIS result in understatements of the potential effectiveness of upland management activities. We also have concerns about the applicability of including a project specific action in a programmatic evaluation, compliance with Clean Water Act Section 404, and a lack of sediment data necessary to support in-water disposal.

The EPA believes that there is potential for significant environmental degradation to the Snake River habitat from the preferred alternative that could be addressed by project modification such as strategically prioritizing actions based on a more regional sediment management approach. For example, if sediment control measures are given a chance to work, permanent in-stream structures may not be needed and significant disturbance to the river and potential impacts to listed salmonids would be avoided. We recommend that the preferred alternative include a measure for the Corps to establish a technical working group among agencies that have responsibilities for sediment management and water quality in the Lower Snake River. Such a group would provide a forum to coordinate monitoring programs, develop a process to share results, and collaborate to implement activities that would facilitate sediment reduction in the basin. This would also support the Corps' goal to reduce sediment in the navigation channel.

The EPA strongly believes that sediment should be managed as a resource in the river system, working with natural transport processes wherever possible, ultimately moving toward environmentally protective and ecologically sustainable sediment management in the Snake River watershed. Many of our attached detailed comments on the DEIS support the regional sediment management approach and reiterate our previous recommendations for watershed based management

We appreciate the Corps' consideration of our comments and look forward to working with you to resolve our concerns about the programmatic sediment management plan. In the interim, we are available to discuss these comments and any questions that you may have. Please contact Lynne McWhorter of my staff at 206-553-0205 or via email at mcwhorter.lynne@epa.gov for further discussion. Thank you for the opportunity to provide comments on the PDEIS.

Sincerely,

Linda Anderson-Carnahan

Linda Anderson-Carnahan, Acting Director
Office of Ecosystems, Tribal and Public Affairs

Enclosures:
Attachment A- Analysis of Mass Balance
Attachment B- Analysis of Sediment Source from Forest Lands Attachment C-
Attachment C- Analysis of Sediment Source from Agriculture Lands
EPA Rating Criteria

EPA Detailed Comments on the
Lower Snake River Programmatic Sediment Management Plan
Draft Environmental Impact Statement

The following are EPA's comments and recommendations on the DEIS. For ease of discussion, we have addressed the two components of the DEIS separately, the Programmatic Evaluation and the Project Specific Dredging Proposal.

PROGRAMMATIC EVALUATION

Summary:

The comments below describe the major issues that form the basis of our objection to the preferred alternative in the programmatic EIS. These include the lack of long-term planning, elimination of measures that support long-term sediment reduction, lack of specificity for adaptive management, potential environmental degradation from selecting specific management measures, and uncertainties about the characterization of sediment sources used as a basis for the measures that are carried forward.

Sediment Management:

Recommended Approach to Sediment Management

The EPA has supported the Corps' efforts to consider activities that address elevated sediment loads in addition to the Corps' conventional dredging approach to sediment management. The Corps' Engineer Research and Development Center included the following technical note on regional sediment management[1], "Regional sediment management integrates Corps planning, engineering and operations activities within coastal, estuarine, and riverine systems, and broadens the problem-solving perspective from a local, project-specific scale, to an extended scale defined by natural sediment processes. The larger spatial and longer temporal perspectives of regional sediment management require the integration of a broad range of disciplines along with collaborative partnerships among agencies, levels of government, and other stakeholders.[2]" We believe this message is consistent with regional sediment management principles adopted by our two agencies at the national level and should be a focus for this DEIS programmatic assessment. However, the preferred alternative does not seem to prioritize collaboration and sediment reduction, but rather focuses on channel and structural measures that may be impediments to supporting more natural river processes. Both of our agencies are engaged in regional watershed management elsewhere; programs such as the Great Lakes Basin Program[3] could serve as models.

Insufficient Inclusion of Long-Term Sediment Reduction Measures:

The DEIS does not identify the temporal scale that is covered by the programmatic evaluation or alternatives. From previous Corps presentations, we understood that the analysis would include a long-term (20+ year) planning horizon. An environmentally sustainable[4] and "systems based approach" to

[1] A "system based approach" to sediment management is stressed in the principles of Regional Sediment Management, as noted on page 3 of Appendix A.

[2] USACE. June 2003. Authorities and Policies Supporting Implementation of Regional Sediment Management. ERDC/RSM-TN-8. http://www.wes.army.mil/rsm/pubs/pdfs/rsm-tn-8.pdf

[3] Great Lakes Basin Program for Soil Erosion and Sediment Control. Task force members of this group include the Corps, EPA and NRCS, State agencies, and regional interests. http://www.glc.org/basin/

[4] Environmental sustainability, proactive consideration of environmental consequences, continued viability of natural systems, and use of systems approaches are included in the Corps's "Environmental Operating Principles," (Introduction DEIS).

addressing sediment management in a long-term plan should include explorations of further reductions of sediment inputs over the identified planning horizon. The chronic sediment sources corroborated by the studies associated with this PSMP/DEIS should be addressed over a long-term basis and at a broad spatial scale. These sediment reduction measures do not appear to have been adequately considered due to the Corps' focus on specific sediment accumulation in the Lower Snake River Project.[5] This focus limited implementation to timeframes of 5 years or less,[6] and included only those measures effective over the narrower spatial scale and in the short timeframes for their "menu of potential measures."[7] While mechanical measures such as dredging may be needed periodically throughout the lifetime of the dams of the LSRP, inclusion of long-term goals and long-term measures such as reduction of sediment inputs from land management practices may well reduce the frequency needed for dredging and other mechanical measures that alter the natural systems.[8] These types of source reduction measures must be considered over the long-term and over the broad spatial scale, not within the constraints of reducing specific sediment accumulation within the LSRP in 5 years or less (the spatial and temporal constraints defined by dredging,[9] the Corps's traditional sediment management measure).

Ecosystem Restoration

The DEIS discusses the development of the PSMP as part of the Corps' civil works planning authority. We understand one of the Corps' civil works' primary missions[10] is ecosystem restoration. This is defined by the Corps as focusing activities to restore significant ecosystem function, structure, and dynamic processes that has been degraded. According to information available from the Corps, the definition of ecosystem restoration includes river restoration as a key topic. The Corps states that, "River restoration includes the removal or remediation of the man-made habitat stressors in rivers that have altered their hydrology, connectivity, water quality, substrate, and other attributes, and have negatively affected their historic ecological integrity resulting in the reduction or elimination of the native species occupying them. River restoration can also include the re-establishment of the associated riparian corridors and flood plains. It can involve the restoration of either an entire river or a smaller section or reach to historic or recent historic conditions, or enhancement of a section of habitat to improve suitability for a particular native species."

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[5] "The purpose of the proposed action is to adopt and implement a PSMP, which includes actions . . . for managing sediment that interferes with the authorized purposes of the LSRP." (DEIS, page 1-2)

[6] All action triggers in the PSMP are in timeframes of 5 years or less (App A, pages 21-24), except for flow conveyance actions that may include a longer timeframe, but in which case the Corps anticipates the potential for one or more cycles of interim actions (App A, page 29).

[7] The PSMP confines the plan to providing "a menu of potential measures that may be applicable for sediment accumulation issues." (App. A, page 1) Appendix A, Table 3-1 provides the list of applicable management measures that are to be evaluated on a project specific basis using criteria that include whether the measures "correct the problem within the desired timeframe to prevent interference with authorized purposes of the LSRP" and whether the measure is "consistent in scale with the identified problem." (App A, page 30)

[8] Because the previous EIS focused solely on managing sediment in the channel (e.g., dredging) and was challenged, the Corps determined it would be more effective to evaluate sediment management within the lower Snake River on a watershed scale, and evaluate the potential for reducing sediment input, rather than focusing only on the reservoirs themselves. Although the Corps does not have the authority to manage land outside of the reservoir project boundaries, the Corps can identify and evaluate management strategies that could be implemented on non-Corps property." (70 FR 190, October 3, 2005, p. 57569) Scoping presentation materials acknowledged the possibility to "Reduce dredging requirements through source reduction, where possible." (Lower Snake River PSMP/EIS Powerpoint Presentation for Grande Ronde Scoping Meeting, November 16, 2006, Slide 4)

[9] "The Corps has dredged problem sediment areas approximately every 3 to 5 years (App A, p. 10)

[10] USACE, March 2013. Ecosystem Restoration Gateway- Civil Works Primary Mission. http://cw-environment.usace.army.mil/restoration.cfm

We agree that emphasizing restoration is important and are pleased that the Corps includes this focus for civil works planning. However, the DEIS does not seem to carry this mission forward in the proposed management measures/action alternatives. Raising levees or installing structures (e.g., dike fields) to alter the river's conveyance of sediment does not seem consistent with a naturally functioning river system. Furthermore, there is no prioritization of the measures. We are concerned that if the Corps selects the preferred alternative as presented in the DEIS, it would allow a project to move forward to construct in-river structures without first considering more restorative practices such as proactively managing the sources of sediment.

Recommendations:

- *We recommend that the final EIS include an overarching principle for regional sediment management and demonstrate how this approach would be carried forward.*
- *We recommend that the final EIS include an approach toward increasing long-term sediment reduction measures consistent with the goal of watershed based management.*
- *We recommend that the final EIS include a discussion of how the management measures are consistent with restoring ecosystem processes and promoting long-term sustainability.*

Adaptive Management:
The DEIS relies on adaptive management; however, the monitoring to inform adaptive management is based only on the Corps' monitoring. Furthermore, the DEIS does not provide details of an adaptive management plan. Appendix A provides a thorough discussion of how a general monitoring program would be implemented. Although this section captures key steps, there are neither specific measures, nor an explanation of a decision framework for how measures would be implemented. An adaptive management plan should be formalized identifying uncertainties (e.g., over 20 percent of the source of sediment is unknown) and providing clear direction to modify decisions as additional monitoring data are obtained.

Appendix A states that the PSMP guides only those actions taken by the Corps within the project boundaries of the LSRP and does not apply to actions taken by other organizations or agencies. For this reason the monitoring focuses on the effectiveness of Corps management activities, disregarding the potentially very important sediment information from upland sources. We note that NEPA allows for consideration of actions outside of the lead agency's authority. Effective, long-term, watershed-based sediment management requires coordinated effort among appropriate agencies. The Corps has a process to convene the Lower Snake Management Group. This would likely be a useful format to use to establish a process for an ongoing technical working group to promote data sharing and other activities, which in turn, would inform adaptive management.

The DEIS acknowledges that dredging will likely be necessary in the future; although on a less frequent basis than past dredging when combined with other management measures. The adaptive management plan does not identify how placement and beneficial use of future dredged material would be determined. There may be a number of opportunities for upland and/or in-water placement where material could be beneficially used for restoration or habitat creation. Gathering such information from stakeholders through an ongoing technical working group would provide a structure for the Corps to consider a suite of options for sediment placement based on changing conditions rather than limiting the options to those immediately available for a particular dredging project.

Recommendations:

- *We recommend that an adaptive management plan be formalized and that land management activities by other agencies should be included and linked back to Corps decisions.*
- *We recommend that the plan include details of how measures (sediment management, system management, reduction measures) would be prioritized.*
- *We recommend that the adaptive management plan include a method to determine beneficial placement of dredged material in the long-term.*

Alternatives:

The DEIS evaluated two action alternatives. Four other alternatives were discussed and eliminated from further analysis. All the alternatives consider various sediment management measures. Measures include additional monitoring, dredging, structural sediment measures, system management measures (levees and managing pool depth), increased upland sediment management, and current levels of upland sediment reduction. The description of alternatives in the DEIS and justification as to why alternatives and measures were eliminated is somewhat confusing. We have developed Table 1 (below) for discussion purposes and to illustrate the full suite of alternatives/potential measures. We believe these measures warrant further consideration.

Table 1 All Alternatives and Measures Discussed in the DEIS

Alternative	Emphasize Additional Monitoring	Increased Sediment Reduction Measures	Continue Current Upland Reduction Measurers	System Management Measures	Structural Management Measures	Dredging Based Sediment Management
Alternative 1	X					
Alternative 2		X				
Alternative 3			**X**	**X**		
Alternative 4			**X**		**X**	
Alternative 5 With Project Specific			**X**			**X**
Alternative 6			**X**	**X**	**X**	

Alternative 7 With Project Specific and Agency Preferred			X	X	X	X

☐ Alternatives/Measures that DEIS identifies would not meet the Purpose and Need

The EPA's Table 1 is based on the alternatives discussion in Chapter 2 of the DEIS. The DEIS states that alternatives and measures were eliminated based on the fact that they, by themselves, would not be effective at reducing sediment accumulation. While we would agree that some measures may not be effective independently, the eliminated measures (and potentially additional ones) could be part of a system-wide approach to reduce sediment accumulation.

The DEIS does not include a decision framework of how management measures would be prioritized. It would appear that without a means to prioritize implementation, structural measures included in the preferred alternative could move forward as proposed projects. The structural management measures would alter the river's natural conveyance and could adversely impact salmonids by increasing habitat for predator species. The effectiveness of these measures seems speculative; impacts may outweigh the benefits. We encourage the Corps to discuss a decision framework for implementing measures that include impacts to salmonids as part of the decision matrix.

The following are other specific issues that we believe should be considered:

- Emphasize continued monitoring. Although the description of action alternatives includes bulleted statements to conduct monitoring, only the No Action emphasizes the task to continue monitoring in order to better characterize sources in the watershed.
- Include measure that emphasizes collaboration with land managers. The DEIS states that wildfire severity is expected to increase resulting in additional sediment load. This point underscores the importance of deliberately engaging in watershed management to address long term sediment reduction.
- Increased upland management was eliminated because it would not reduce sediment accumulation as a stand-alone action. We believe that increased restoration of uplands may provide benefit and could be combined with less frequent dredging while avoiding the proposal to construct in-water man-made structures.
- Include a measure to create a collaborative forum of land managers to promote strategic restoration opportunities. While limited agency resources may impact the ability to increase upland management, using current resources to more deliberately direct and help prioritize/inform efforts could be an effective measure to include in the preferred alternative.
- Alternative 7 assumes all measures are available to implement (except those under Alternative 1 and 2). It appears that this would allow the Corps to move forward with structural measures without first prioritizing monitoring, additional source characterization, or collaboration of

management activities. Because of this lack of prioritization, Alternative 7 could result in unnecessary degradation of river's natural flow above the Lower Granite Dam.

- Most of the alternatives were eliminated from further evaluation because they did not meet the purpose and need; however Alternative 7 includes these measures. It is unclear if the intent is to implement all of the measures under Alternative 7 since they would not be effective on their own or implement each independently or implement them in combination with only one or two other measures. This seems unlikely and therefore we are unsure how Alternative 7 would be effective. Please clarify in the final EIS.
- More discussion is needed on current management activities. The action alternatives include a measure to continue current upland management with a bulleted list of the relevant agencies. The Corps's upland management is identified; however, there is no discussion about these current management activities or those of other agencies. Therefore, it is not clear how this measure (current activities) would meet the purpose and need. Also, it is not clear how this measure would meet the purpose and need, while the alternative that increases upland management would not.
- We believe that structural management measures should be a last resort. These measures will require maintenance in perpetuity, have in-river effects in perpetuity, and do not seem to be consistent with Corps' sustainable practices as outlined in the PSMP as "Environmental Operating Principles."
- We recommend including a table in the EIS similar to EPA's Table 1 to clarify measures carried forward in the action alternatives.

Recommendations:

- *We recommend that the final EIS include additional information on the decision framework for prioritizing measures and further consider the impacts to ESA listed species.*
- *-We recommend that the preferred alternative include a measure that emphasizes monitoring to continue source characterization and resolve unknowns.*
- *We recommend that the preferred alternative be modified to include a commitment to collaborate with relevant stakeholders. We recommend including more detail on how continued collaboration would occur and who would be involved in developing an agreement for continued coordination of sediment management on a watershed scale. This will aid in the understanding of how decisions will be made for implementing actions/sediment measures and how efforts will be combined and prioritized in the watershed.*
- *We recommend that EPA's specific comments in the bulleted list above be addressed in the final EIS.*

Uncertainties with Sediment Characterization

The comments below discuss our concerns about the unknown sources identified in the mass balance of sediment, the exclusion of bedload in the assessment, and the dismissal of anthropogenic activities' effects on sediment loading from forest and agriculture lands. We believe that additional monitoring and characterization are critical to address these uncertainties. Our expanded analysis is included in attachments A, B and C, which further discuss these uncertainties and our concerns about the interpretation of studies that narrowed the range of management measures carried forward.

<u>Mass Balance and Unknown Sources</u>

The sediment mass balance presented in the DEIS (Appendix F) shows that the largest source of both the suspended sediment load and suspended sand load reaching the Lower Granite Reservoir originates from the Salmon River system, indicating that the Salmon River basin may be a good candidate for watershed sediment management[11]. It is important to note that large amounts of sediment loading originates from the other 'tributary' sources within the project area, and therefore these areas are also potential candidates for watershed sediment management. Since sediment reaching the confluence of the Snake and Clearwater Rivers are influenced by upstream processes, we believe the preferred alternative in the DEIS should include a watershed sediment management and monitoring component.

The mass balance presented in the DEIS does not identify the source(s) of between 21% and 33% of the sediment load that reaches the Lower Granite Reservoir.[12] This 'unknown' sediment load adds a level of uncertainty to the watershed analysis presented in the DEIS. Accordingly, based on the uncertainty associated with the 'unknown' component of the mass balance it would be prudent to continue monitoring watershed sediment processes in order to determine the source of this 'unknown' sediment, with a goal of developing watershed sediment management of the 'unknown' sediment source(s) along with the 'known' sediment sources.

Bedload Sediment

The DEIS does not include bedload as a source of sediment accumulation in the Lower Granite Reservoir. It is possible that a portion of the 'unknown' component of the mass balance could be the re-suspension of bedload. Bedload sediment is a large component of the sediment regime traveling through the Snake and Clearwater Rivers (2 to 10% of the total sediment budget) and it is possible that bedload is re-suspended into the water column at higher flow conditions. If this occurs, then bedload produced by watershed processes (e.g., 'mass-failures') could have a much more immediate effect on sediment conditions at the confluence of the Snake and Clearwater Rivers. That is, transport rates for suspended sediment in a river are much shorter than the transportation rate associated with riverine bedload sediment. We believe that the EIS should consider bedload as a potential source of sediment accumulation at the confluence of the Snake and Clearwater Rivers.

Sediment from Forest Lands:

The DEIS states that several very large forest fire events have occurred in the project area during the past decade and that the forest fire regime may increase in frequency, severity, and intensity in the near future as a result of changing climate patterns. One potential outcome from these fires is increased sediment loading to the river system. Specifically, it was reported in Appendix D that fires will increase the number of sediment 'mass-wasting' events, which have been shown to be significant sources of sediment production. It can be anticipated that sediment loading from fire initiated 'mass-wasting' will eventually reach the confluence of the Clearwater and Snake Rivers as it slowly travels downstream (i.e., decades) as both bedload and suspended load. We would note that the implementation time frame used in the DEIS, currently restricted to 5 years or less,[13] seems short to effectively evaluate and address the impacts of current and expected future fire induced mass-wasting sediment loading events.

In addition, the DEIS implies that sediment loading from fires has no anthropogenic component because fire is a natural process and therefore, there was no need for additional monitoring or management of

[11] A detailed discussion on the mass balance is presented in Attachment A of this letter.

[12] In other words, the sediment budget presented in Appendix F accounted for only 66% of sediment load in certain situations (i.e., 100% – 33% = 66%), with the remaining sediment load being from an 'unknown' origin (i.e., 33%).

[13] All action triggers in the PSMP are in timeframes of 5 years or less (App A, pages 21-24), except for flow conveyance actions that may include a longer timeframe, but in which case the Corps anticipates the potential for one or more cycles of interim actions (App A, page 29).

these sediment loads. We believe the DEIS does not adequately consider the contribution of anthropogenic activities and conditions (e.g., roads and culverts) to the creation of 'mass-wasting' events. Mass wasting events resulting from fires may be influenced by past and present forest land management actions.[14] For example, areas where road density is high or where culverts are undersized or in disrepair would be more vulnerable to the likelihood of mass wasting after a fire.

Road failures have been shown to be a very important sediment source. For example, Elliot et al. (1994) reported that a road culvert failure produced high quantities of sediment that reached a stream (i.e., 3,200% over natural loading levels). Similarly, it was reported in Appendix C of the DEIS that during the 1995/1996 storm event, 35% of the total estimated landslide volume in the Clearwater National Forest was from roads, while 25% of the total estimated volume delivered to streams was from roads. Neither of these examples was reported to be associated with fire events.

It is important to point out that the frequency of road "mass failure" events, not associated with wildfire effects, have been successfully addressed by the USFS over the past decade through road management programs. These activities have been shown to improve water quality through reduced sediment yields. Although the USFS is working on issues with roads, it is likely that additional actions will be needed to mitigate potential future anthropogenic mass wasting events, as the predicted fire regime produces hotter, larger, and more frequent fires. For example, some of these anthropogenic activities (e.g., roads) may not currently result in mass-wasting events, but they may in the future with the new fire regime. Based on the uncertainty associated with the potential increase of mass wasting from road failures, we believe it would be prudent to continue monitoring watershed sediment processes. We also believe that there could be opportunities for the Corps to partner with the Forest Service on reducing sediment loading into rivers from forest roads in the Clearwater and Snake River basins.

<u>Sediment from Agriculture Lands:</u>
We agree with the discussion in the DEIS that agriculture practices have improved dramatically over the past several decades resulting in much lower surface erosion (i.e., sheet and rill) from agricultural lands. However, potential sediment loading from ephemeral gullies on agriculture lands were not addressed during the watershed analysis for agricultural lands (Appendix E in the DEIS)[15]. Extrapolating ephemeral gully production observed within the Potlatch basin (i.e., 26.2 ephemeral gullies per square mile of agriculture land) to all of the agricultural areas within the project watershed area (i.e., 284 mi^2), results in an estimated 81,276 ephemeral gullies produced per year. Although this is a very rough estimate, this value does indicate that many ephemeral gullies can be produced within the project watershed area. It is possible that a small fraction of these gullies will produce sediment that is routed through the system, which may, in turn, influence the sediment budget at the confluence of the Snake and Clearwater Rivers.

As previously mentioned in this letter, there was a large 'unknown' component in the mass balance for both suspended sediment and suspended sand loads. It is possible that sediment resulting from ephemeral gully formation on agriculture lands could drain into small tributaries that enter directly into the mainstem Snake and Clearwater Rivers. These small tributaries were not monitored during the development of the mass balance model.

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[14] A detailed discussion on forestry issues are presented in Attachment B of this letter.
[15] A detailed discussion on agriculture issues are presented in Attachment C of this letter.

Sediment from Grazing Activities

The issue of sediment production resulting from grazing activities was not addressed in the DEIS. Grazing activities have been shown to dramatically increase sediment loading into a stream through direct riparian disturbance (e.g., grazing and/or trampling), as well as indirect effects resulting from changes in hydrology (e.g., increased peak flow, total flow, etc) which can lead to increased sediment production within the stream from eroding banks. Hydrologic changes from grazing activities can be a consequence of lower vegetation cover densities and changes in vegetation types. For example, two of largest sediment debris flow events in the Boise River Basin were a result of over-grazing activities during the 1970's[16]. Because a fairly large portion of the Snake and Clearwater River basins include grazing activities, it is problematic that the potential effect of grazing activities on sediment production were not addressed in the DEIS.

Recommendations:

- *We believe that it is necessary to continue monitoring watershed sediment processes because of the uncertainties with the characterization of sediment in the DEIS. The final EIS should emphasize this activity.*
- *We believe that the analysis should further consider the ability of land management activities to contribute to the overall sediment reduction. This may appropriately promote more long-term solutions given the expected increase in wild fire and the subsequently expected increase in sediment delivery.*
- *We believe that the analysis should include the potential sources of sediment from grazing activities.*

PROJECT SPECIFIC DREDGING

Summary:

The programmatic EIS includes a project specific proposed action to dredge in 2013/2014 to address the immediate need to maintain the federal navigation channel and adjacent berths. This inclusion seems inconsistent with a programmatic approach. Based on CEQ[17] guidance, a programmatic EIS can be used for broad federal actions. The NEPA Book[18]refers to programmatic analyses as a "strategic environment assessment" and distinguishes between programmatic EISs and project specific EISs. It states that agencies focus on different factors when preparing each. Programmatic EISs do not typically evaluate defined facilities or specific sites. The DEIS states specifically that the PSMP "does not prescribe project-specific solutions[19]" Therefore, we are unclear how the project specific proposal informs the decision considered in this PSMP.

That said, we have reviewed the project specific proposal and have some initial comments and recommendations. Additional detailed comments will be forthcoming in our review of the public notice.

The DEIS does not fully analyze the effects of in-water disposal or appear compliant with the 404(b)(1) Guidelines. The EPA often supports in-water disposal of dredged material; however, the EIS should more rigorously document that in-water disposal for the immediate maintenance action complies with

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[16] USFS Charlie Luce, Research Hydrologst. 2013. Personal Communication.

[17] CEQ. 2003. Modernizing NEPA Implementation. http://ceq.hss.doe.gov/ntf/report/chapter3.pdf

[18] Bass, Ronald E. 2001. The NEPA Book: A step-by-step guide on how to comply with the National Environmental Policy Act. Pgs 63-65. Salano Press Books.

[19] DEIS, Appendix A, Section 1.1.

the Guidelines. Based on the available information, we do not believe the proposed action has been clearly demonstrated to be the least environmentally damaging practicable alternative.

Recommendations:

- *We recommend that the final EIS address the alternatives analysis for future disposal of dredged material, both in-water and in appropriate and available upland areas.*
- *We recommend that a full suite of disposal alternatives that could support beneficial use (e.g., uplands, in-water, and combination thereof, at individual or multiple sites) be evaluated for practicability.*
- *We recommend that the final EIS clearly demonstrate the need to create shallow water habitat for juvenile salmonids at the Knoxway Canyon site, should in-water disposal be the only practicable alternative.*
- *We recommend that the final EIS clearly demonstrate selection of the Least Environmentally Damaging Practicable Alternative.*

Uncertainties with Sediment Quality:

Along with our responsibility under CWA Section 404, we also review and comment on the suitability of sediment for in-water disposal/placement. The DEIS does not provide sufficient information to determine the suitability of immediate need dredged material prism for in-water placement. The EPA is a participant in the interagency Dredged Material Management Program. The purpose of the DMMP is to coordinate multi-agency (Corps of Engineers, Washington State Departments of Ecology and Natural Resources, and the EPA) review of sediment testing and management of dredged material to ensure protection of the aquatic environment. It is our understanding that Walla Walla District is enlisting the assistance of the Seattle District to have sediment characterization information compiled and presented in a format consistent with the DMMP. The DMMP is one process available to assist in the interagency review of information and although using this specific process is not required, the same level of information gathered for this process should be provided to agencies to assess the quality of sediment. Sampling, testing, interpretation and submittals should be consistent with the interagency manual *Sediment Evaluation Framework for the Pacific Northwest.*

We reviewed the DEIS and appendices for information provided to date that might support sediment quality statements throughout the DEIS and supporting documents. From our review we have identified a lack of information (i.e. an adequate final sediment characterization report) to determine the suitability of sediment for in-water disposal/placement. The following comments discuss our main issues with the DEIS and appendices regarding sediment quality.

<u>Sediment Sampling for Suitability Determination</u>

Two sediment sampling efforts have occurred in the project area recently, both supporting 2013 proposed dredging. The Port of Clarkson conducted sampling on approximately 2500 cy of material at their crane dock berth. They followed the DMMP process, which resulted in a suitability determination that found all of the Port of Clarkson's crane dock material suitable for unconfined, open-water disposal (February 22, 2013 signed by the EPA, Ecology, WDNR and Seattle District Corps). These testing results should be included in the final EIS, appendices and references.

The second effort was Walla Walla District's sampling in August 2011 in support of the EIS which is now being used to support proposed 2013-2014 "immediate need" dredging. Unfortunately the sampling and analysis plan was not coordinated prior to sampling. Subsequent to the sampling the EPA was told that Walla Walla District intended to work with Seattle District and the DMMP agencies to review and interpret the data, with the intention of getting a signed suitability determination for the immediate need dredging. In early October 2012 a draft data report (dated September 2012) was circulated to the DMMP agencies by Seattle District on behalf of Walla Walla District. The report did not include basic information that would allow a reasonable review. For example there was not an adequate description of the fieldwork and compositing scheme, grain size data, number of samples related to proposed dredging volume, basic tables comparing the data to applicable limits, detection limits, supporting information explaining how the Corps determined to sample grain size for a certain portion of samples and do chemical analyses for others. Interagency initial comments/requests for clarification were submitted by the Seattle District to Walla Walla District in mid-October 2012, with the understanding that, per the DMMP process, a more complete reviewable draft data report would be resubmitted for consideration. This was also the Seattle District's understanding.

We have had informal discussions with the Seattle and Walla Walla Districts and have been anticipating a revised draft sediment report. In its absence, the DEIS lacks supporting documentation related to the suitability of the material for the proposed placement project. Conclusions about the suitability of material for in-water placement/beneficial use are not supported by the draft September 2012 report provided in Appendix I. In order to conduct our review, we require a sediment characterization report clearly documenting the Corps' fieldwork and reasoning in August 2011 with an analysis that includes comparisons of all data to appropriate, agreed to screening values. This is necessary before the Corps can finalize environmental documentation for this project, and before agencies can provide informed comments about the project. Based on current information it is unclear whether the level of documentation (e.g. locations, number and types of samples and detection limits) is adequate to characterize this project without further testing. We have included specific comments in the table following our general comments below. Many of these comments highlight the lack of information to determine sediment quality. Furthermore, the EIS, appendices and Biological Assessment inaccurately conclude that all proposed dredged material has been found suitable for unconfined, open-water disposal and for use in the proposed fish habitat.

Water Quality Monitoring Report and Sediment Quality

The DEIS does not include the most recent water quality results from the 2006 Water Quality Monitoring Report, which provides real-time results applicable to active dredging activities as well as placement and regrading activities at the previous placement site, adjacent to the current proposed placement site. For example, section 4.6.2.1 of the EIS states that the "turbidity levels would be expected to meet state water quality standards 300 feet downstream from dredging and placement actions…" . The Corps' 2006 water quality monitoring report[20] states that during the 851 hours of dredging in the reach near Port of Clarkston, the project was in compliance only 64% of the time with an average turbidity of 5.84 NTU over background (at a deep station 300+ feet downstream). Due to the "monitoring zone" construct, this station was likely more than 300 feet downstream, with the deep station 600 feet or more downstream in compliance 85% of the time. The report states that the dredge operations were consistently halted during this project phase to allow turbidity levels to decrease to within specified limits.

In addition, the water quality monitoring report states that, "During the final phase of the dredging operation (March 3, 2006), the main dredge *Vulcan* was relocated to the disposal area, specifically to

[20] USACE. 2006. Water Quality Final Report, FY 06 Lower Snake River Dredging Project, Manson Construction Company

reshape the disposed material. This activity was closely monitored for elevated turbidity, and both compliance stations did signal alarms for a long series of elevated turbidity, ceasing operation in excess of 10 hours. The threshold for this operation was raised to 75 NTU, which was implemented on March 3, 2006." While it may be decided that the short-term turbidity effects are reasonable and unavoidable in order to accomplish the final shaping/dressing of the benches, these effects should be anticipated and actual results should be clearly summarized and discussed in the water quality sections of the EIS and all appendices, including the Biological Assessment and 404(b)(1) analysis.

The conclusion of this 2006 report states that, "Turbidity was the only parameter influenced by the dredging program." Other measured parameters were pH, DO, specific conductivity temperature and ammonia. "The frequency of turbidity concentrations that approached the criteria established...was directly related to the material being dredged rather than the dredging methodology or rate." While we can agree that dredging gravel will not produce the turbidity that dredging finer grained material will, certainly adjusting the rate of dredging and potentially other BMPs such as dewatering rate, etc. will influence the levels of turbidity measured downstream during dredging.

<u>Appendices</u>

-Appendix I: Sediment Evaluation Report (September 2012).

The DMMP reviewed this report and awaits an updated report that addresses DMMP comments (comments provided October 2012 attached). Because we do not have a complete report, we are unable to confirm statements about the sediment's suitability for habitat bench placement.

-Appendix K: Biological Assessment

The BA should be aligned with the other project documents to ensure that acres, volumes, etc. are consistent throughout all project documents. Our comments in the table below related to the project description, lack of or new sediment characterization information and interpretation, and need to provide linkage to past water quality monitoring, apply to the BA as well.

Recommendations:

- *We recommend that the EIS include adequate detail to determine whether or not the sediment is acceptable for in-water disposal. Without review of this information, the EPA does not support this action.*
- *We recommend that EPA's specific comments in Table 2 be addressed in the final EIS.*

Table 2 EPA Specific Comments Related to Sediment Quality

Document	Section	Page	Comment
DEIS	1.3.2	1-7	Sediment Management Guidance. A statement should be included about additional assessment, beyond the SEF, of dredged material in terms of specific beneficial use requirements, and whether any given material is appropriate for the use proposed.
DEIS	3.6	3-53	This discussion should be updated with data from the 2011 sampling, along with the Port of Clarkston's 2012 data. A statement such as in paragraph 3 that for 2000 and 2003 "all *detected* concentrations of contaminants were below screening levels", also requires a statement about the list of chemicals of concern (e.g. SEF chemicals) that were tested for, and that all detection limits were below the applicable SLs – otherwise

			this is an inadequate summary of testing results. The 2011 sampling report referenced in Appendix I is incomplete. The DMMP agencies provided initial comments in October and are awaiting an updated report. Without it, any comments about appropriateness of the current dredged material prism for in-water placement are not supported. The analysis should discuss the standards were used for comparison of results. Have regional sediment evaluation programs evaluated the results? If so, where are these evaluations? And if not, please explain.
DEIS	4.1	4-1	Plankton and Benthic Community discussions. All alternatives about effects on plankton and benthic community should mention the quality of the dredged material. Potential chemical contaminants -- and the fact that testing and a suitability determination documents whether sufficient information exists to support these analyses and whether these resources are protected -- are not mentioned anywhere in these alternatives evaluations. Sufficient evaluation of material, as could be documented in a suitability determination, is central to no and minor short-term effects calls in the document.
DEIS		3-54	This entire paragraph is not supported by any report and should be removed pending receipt of a final characterization report. The EPA disagrees with the statement that, "Based on the results from the study, the sediment at the Port of Clarkston, Port of Lewiston and the navigation channel in the confluence area meet the chemical and physical criteria for open and unconfined in-water placement." The existing data are not packaged in such a way (e.g. a complete report) that this can be determined for the most recent (2011) dataset that best represents the proposed dredging prism (with the exception of the Port of Clarkston crane dock).
DEIS	4.6.2.1	4-36	Statements that information in Appendix I and the 2011 sediment sampling results indicate that materials from the proposed dredging meet criteria for open-water disposal are premature given the lack of a complete sediment characterization report.
DEIS	4.6.2.2	4-36 – 4-37	Immediate Action. As discussed previously, there is no sediment report is available to support statements about suitability of material for placement. Again, the DEIS should reference water quality monitoring results for each phase of the proposed actions.
DEIS	4.6.3.1	4-37- 4-38	Similar as comments on Section 3.6 and 4.1 above. How was it determined that the "agitation" measures would have the same effects and duration as dredging…since the water column is being used to convey the full volume of sediments it would seem to potentially have far greater turbidity impacts, and be quite different from dredging. Please provide a better

			explanation of what exactly is anticipated with "agitation" and therefore what the water quality effects would be relative to dredging.
	4.6.3.1	4-38	Please include the turbidity values during the referenced 1992 test drawdown of Lower Granite Reservoir.
Appendix H	General		What is the ownership of the dredging areas (and hence the dredged material) and the Knoxway Canyon placement site? If there are state-owned aquatic lands, managed by WDNR, it should be clearly stated.
Appendix H			Inconsistencies in dredging and acres of impact. Update all documents with current likely maximum dredging volumes and acres of impact. These numbers vary in the appendices and BA…ie. 50 and 72+ acres of dredged surface area, 422K cy and 500K cy of dredging, different acres of good vs. fair habitat at the habitat site, etc.
Appendix H		4, Figure 2	Include this aerial; however, the title should indicate that this shows the Federal project at the confluence, not the actual shoaling.
Appendix H		6	This page, including grain size information, must be updated and reference the final approved sediment characterization report from Walla Walla District (when available), along with the Port of Clarkston's most recent crane dock sediment data report. Does Port of Lewiston have adequate sediment characterization of their berth like Port of Clarkston crane dock – does the Corps data cover this area? Does the Port of Clarkston's upstream berth area have adequate sediment characterization – does the Corps data cover this area? Consistent grain size statements are needed throughout the documents.
Appendix H		10	Please explain how the contractor will "overspill excess water from the barge" 2 feet below the river surface.
Appendix H	4.1.1	11	Joso disposal site. While Joso is not a preferred disposal site, it could hold some dredged material at some point, or might be a worthwhile restoration site. The Joso discussion needs a few more details including an estimate on the volume and footprint of dredging that would be required to have access to the disposal site, and why an 80 acre retention pond would have to be constructed? If cranes are offloading sandy dredged material, it doesn't seem like there would be much required dewatering? How much capacity is at the Joso site?
Appendix H	4.1.2	12	Port of Wilma. Similar to Joso, this option may not hold all the material, but could be an upland option for some of the dredged material if needed.
Appendix H	4.2	12	States that if funding or other issues meant the habitat option could not be pursued, open-water disposal might be pursued…identifying a site that "would not impact the navigation channel or other project purposes or have an

			unacceptable impact on environmental resources"...? If this option were pursued this section would require much more detail including a clear description of how a site would be selected, a description of depths considered shallow, mid-depth and deep, and a description of how this site would be monitored in the short and long-term. In addition, explain how habitat is created at depth for species that prey on salmonids.
Appendix H	4.3	13	Resource agencies like the Services will have to ensure that the in-river disposal being proposed continues to have their "qualified support" in terms of benefits to salmonids. Page 14 again mentions habitat will be created "subject to availability of funds". Is it possible dredging will occur, but the habitat option will not be pursued because of funding?
Appendix H		14	Please provide more details on the construction methods and stability of the existing Knoxway bench. How was the material placed and reworked in 2005/2006? Was sand placed on top similar to the 10 foot surface layer that is proposed for the ribbon option this year?
Appendix H		15, Figure 8	What is the date of this survey (2006 or 2011?). From the figure there appear to already be benches/deltas at the mouths of the gullies flowing into this reach...will any good existing habitat be affected by the ribbon proposal? Also, please ensure the acres/depths are consistent with other locations in the document, including the BA. The new proposed placement footprint should be superimposed on a figure with bathymetry like Figure 8 in addition to that provided in Figure 9.
Appendix H		17, Figure 10	Please include labels that show depths of the margins and acres for each area, not just the shallow water area.
Appendix H		19	All dredging will be mechanical e.g. clamshell. It should be made clear that the initial placement of Ice Harbor and then other materials would be by bottom dump barge. It is then stated that the final material lifts will be removed from the barge and placed via hydraulic or mechanical methods, once bottom dump barges can no longer access the shallow area. How was the other bench constructed? How would hydraulic pump out really be used to do the final placement and reshaping of the surface of the bench to meet depth and slope requirements? Slurry would cause turbidity effects downstream – potentially more than happened in 2005-2006. How will the 10 ft depth of sand be confirmed? Has the dredging prism been characterized well enough to define the grain sizes and ensure sequential placement? Reference the final sediment characterization report when it is available. Where will the sand for the top of the bench be dredged, and how much volume is needed for the final 10 foot lift of sand?
Appendix		20	How often is "periodically" when defining frequency of

H			hydrographic surveys post-placement? How has the 2005-2006 bench performed/changed in terms of stability in the years post-placement? Was the top of the bench dressed with sand, and has the sand remained?
Appendix J	3.1.2	4	Add the Gottfried et al 2011 reference to the references section.
Appendix J		5	What does "proposed templates" refer to in the juvenile lamprey discussion...dredging and disposal areas?
Appendix J	3.2.1	6	Water Quality Monitoring. Only in the BA (Appendix K) is there brief discussion of the past water quality monitoring results conducted during dredging and placement in 2005-2006 (see BA p. 87 section 6.4.2 and especially BA p. 90 Table 17). This is significant because the actual 2006 Water Quality Monitoring report indicates numerous exceedances of the Washington state turbidity standards during both dredging and placement activities in 2005/2006. In the BA and other project documents discussion is lacking on how water quality monitoring results affected dredging or placement activities real time, and whether any discussion of the environmental significance of the findings occurred at that time. Discuss what placement activity was occurring (e.g. bottom dumping, reworking the surface, mechanical or hydraulic placement) when placement site exceedances occurred. The 2006 Water Quality Monitoring Report must be discussed in the EIS in the Environmental Effects of Alternatives section, and should help inform agency review and creation of a water quality monitoring plan for the current proposal. Particularly the Washington State Department of Ecology (Ecology) should be provided past results along with the current proposed water quality monitoring plan.
Appendix J		7, Figure 1	Ecology may again determine that (per WAC 173-201A-200 Freshwater) the turbidity point of compliance is 300 feet downstream of the activity causing the turbidity exceedance. Given the fixed array system, and use of a monitoring zone of 1000 ft x 600 feet around the active dredging site (Figure 1), it looks like active dredging could occur anywhere from 300 feet to 1300 feet away from the fixed array during monitoring. The placement site monitoring includes a monitoring zone 1000 feet x 400 feet – Figure 2. Given this monitoring network was also used in 2006, it may be anticipated that turbidity exceedances will occur and that they will be farther than 300 feet from the monitored activity. There is no discussion of what happened in 2006, or is proposed to happen now, when an exceedance is detected...are those details expected to be imposed in the state water quality certification? Please present what happened in 2005/2006, including examples of changes in the activity or BMPs that were initiated or could be initiated

			to resolve anticipated turbidity exceedances.
Appendix J		8, Figure1 and 9 Figure 2	Please add distances to these figures. E.g. Figure 1 sides of monitoring zone are 1000 feet and 600 feet, and compliance stations are 300 feet from the downstream edge of the zone, etc.
Appendix J	3.3	9	It is good to see that hydrographic surveys are anticipated during the 2-3 years post-placement. In Section 3.3.1, to assess "long-term" stability it would seem a 10 year survey would also be needed – which would complement the results/timing anticipated for Biological monitoring in Section 3.3.2. Also, would the grain size/substrate of the bench surface be tested?
Appendix J	3.3.2	10	Why has the sampling timing been modified...is it based on the previous monitoring?
Appendix J	4.2.1	13	Turbidity standards and compliance boundaries should be confirmed with Ecology. How would notification of Ecology occur should there be exceedances? Given the need to define a "protocol yet to be determined for turbidity" (section 4.2.2), how were exceedances actually handled in 2005/2006? Indicate how often dredging or placement was stopped due to continued exceedances? What were effective BMPs for handling the turbidity last time around?
Appendix J	4.2.2	13	If the Washington dissolved oxygen (DO) standard is 8 mg/L, why is 5 mg/L mentioned as the action level in the second paragraph
Appendix J	4.2.4	14	It appears that the temperature section was cut off. How often is temperature verified?
Appendix J	4.3	14	Both changes in elevations and/or grain size/substrate might indicate movement of material. It is not clear how the sediment sampling records are going to help evaluate the composition of the dredged material disposed at any given bench placement location? Settling differences in the water column, as well as in situ variation, for example may make the comparison moot. In addition, the surface will be dressed with at least 10 feet of sand. The berm idea would be worth evaluating however.
Appendix K		24	This section should mention the top dressing of 10 feet of sand, etc. The dredging plan mentions that hydraulic placement could be an option for this activity. Include better figure along with Figure 9 here – one that shows bathymetry.
Appendix K		27	Either in this section or elsewhere in the BA, there should be a clear discussion of turbidity exceedances that occurred during the 2006 dredging/placement project, including how many, where, during what activities, and for how long?
Appendix K		28	Again, how were exceedances addressed? Figure 11 should have distances marked. Where is a figure showing monitoring array at the placement site?

Appendix K		29	Why does it only mention one post-placement monitoring event for stability, when more are mentioned in other documents?
Appendix K	3.8	31, First Bullet	How will the Corps "encourage" other Federal agencies to reduce sedimentation? What activities will occur? We recommend a more concrete plan for coordination and sharing of information here.
Appendix K	3.8.2	32	It is incorrect to say that no contaminants in excess of regulatory thresholds have been found...we are awaiting the sediment characterization report. There are upland disposal options identified, if needed. Although they may be expensive, they also could be available.
Appendix K		76	Background/Baseline Turbidity section. Provide a reference for the background turbidity information and where/when it was obtained. It is useful to know that the average background turbidity level during the 2005/2006 dredging was less than 5 NTUs. Provide a citation to the report. Washington does not have a 25 NTU background action limit.
Appendix K		76-77	Chemical Contaminants section. No report has been accepted or reviewed that adequately supports the statements contained here. This section should be rewritten once a final report is produced, and should also include the Port of Clarkston crane dock information. A referenced report should be included in the final EIS.
Appendix K		80	This section needs to be rewritten once a final sediment characterization report is available.
Appendix K		90, Table 17	Include the dates 2005/2006 and dredging/disposal in the table caption. This table is important and needs to be able to stand alone, while the pertinent text should include a better narrative description of the results. Do these represent the best BMPs we can do? Were BMPs implemented? What activities seemed to contribute the most to the exceedances? Where is the high 15 NTU value mentioned in the text on page 89? Without a better tie in to the 2006 water quality monitoring report, it is unclear what the stationing of 300, 400 and 900 mean in terms of distance from the ongoing activity. The disposal site numbers lack the "average turbidity over" row which is provided for the dredging locations?
Appendix K	6.4.4	91	Chemical Contamination. No reference is available at this point to support or refute the contention here that... "Only a very small number of samples contained contaminants higher than Washington and Idaho regulatory criteria." What criteria? Ultimately, when the report is available, this section should be updated.
Appendix K	6.5.1.1	92-93	Spawning and juvenile rearing areas. Water Quality. Table 17 and the earlier narrative do not make it clear that standards were only exceeded by a small amount for short periods. See

			comment. Also, Table 17 does not include a value of 15 NTU. Good to see some narrative that describes the types of activities that were causing the turbidity (scow bottom dumping) and those levels dropped between scow dumping events. Can this kind of detail be provided for areas that exceeded during dredging? Again, a sediment characterization report must confirm the contention that low levels of contaminants were found in a small number of samples.

U.S. Environmental Protection Agency Rating System for Draft Environmental Impact Statements Definitions and Follow-Up Action*

Environmental Impact of the Action

LO – Lack of Objections
The U.S. Environmental Protection Agency (EPA) review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC – Environmental Concerns
EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce these impacts.

EO – Environmental Objections
EPA review has identified significant environmental impacts that should be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no-action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU – Environmentally Unsatisfactory
EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the Council on Environmental Quality (CEQ).

Adequacy of the Impact Statement

Category 1 – Adequate
EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis of data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2 – Insufficient Information
The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses or discussion should be included in the final EIS.

Category 3 – Inadequate
EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the National Environmental Policy Act and or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

* From EPA Manual 1640 Policy and Procedures for the Review of Federal Actions Impacting the Environment. February, 1987.

Attachment A – Mass Balance Comments

Proportional total suspended sediment loads and suspended sand loads measured during water years 2009 through 2011 were presented in Appendix F of DEIS. The majority of the sediment load observed at the confluence of the Snake and Clearwater rivers originates from the Salmon River system (i.e., 53.5% and 65.2%, respectively) (**Figures 1 and 2**). Accordingly, future watershed sediment management activities intended to reduce sediment loading at the confluence of the Snake and Clearwater Rivers should include efforts in the Salmon River system. However, it is important to point out that the relative contributions of the other sources add up to a significant proportion of the total load (i.e., 15% for suspended sediment and 10% for suspended sand). Accordingly, future watershed sediment management activities should also address these areas.

Of particular note in **Figures 1 and 2** are the 'unknown' sources of suspended sediment and sand within these river systems. For example, 26% and 32% of the suspended sediment load is from an 'unknown' origin in the Clearwater and Snake River basins, respectively (**Table 1**). Similarly, 21% and 26% of the suspended sand load is from an 'unknown' origin in the Clearwater and Snake River Basins, respectively (**Table 2**). These results indicate that there may be other sources of sediment not accounted for by this monitoring effort. There are two potential reasons for the observed high amount of 'excess' sediment during the monitoring efforts.

First, it is possible that sediment loading from small tributaries, along with land areas and stream banks surrounding the mainstem Snake and Clearwater Rivers, were the source of this 'excess' sediment. These areas were not monitored and therefore could be the source of this 'excess' sediment.

Second, it could be possible that the 'unknown' sediment source is a resuspension of the bedload sediment located along the mainstem stream channels in both the Snake and Clearwater rivers. Bedload transport of sediment can be a large portion of the sediment budget. For example, sediment bedload has been generally reported between 5 to 15 percent of the total sediment load (Parkinson, et al., 2003). Similarly, a USGS study observed that bedload in the Snake and Clearwater Rivers was between 2 and 10 percent of the suspended sediment load and averaged 5 percent (Jones and Seitz, 1980). It is important to note that bedload transport of sediment is traveling along the bottom of the stream channel, and this sediment source would need to be re-suspended into the water column in order for it to become part of the 'suspended' component of the sediment budget. It might be possible for this to happen at high flow rates in these rivers. If this does occur, then the bedload would have a much larger influence on the sediment budget than was previously considered (i.e., bedload plus re-suspended bedload).

The travel rate of bedload sediment in a river system is much slower than suspended sediment. Accordingly, the time lag between the upland disturbance activity and the arrival of this bedload sediment at some distant downstream location can be very long, making it very difficult to establish an association between upstream land-use and sediment conditions in the downstream river segment. It was reported in Appendix F of the DEIS that the forest fire regime within this project area is expected to increase in frequency, severity, and intensity. These fires can result in a very large production of bedload sediment through the production of 'mass-failure' events. This produced sediment load will take a long time to reach the confluence of the Snake and Clearwater Rivers, but some of this sediment load will eventually reach this confluence. If bedload is a greater factor of the sediment budget than previously anticipated, then the impact of this current situation on future conditions will be much greater than anticipated. Similarly, bedload from other non-fire related sources (i.e., mass wasting sources of bedload resulting from failing roads or clearcut harvest) can have a greater impact on the sediment condition at this confluence than previously anticipated.

Finally, this 'unknown' category adds a level of uncertainty with the watershed analysis. Accordingly, it would be prudent to continue to monitor and investigate potential sediment sources within the basin in order to address current and potential future sediment sources that will cause problems at the confluence of the Snake and Clearwater Rivers.

References Cited

Jones M., and H. Seitz. 1980. Sediment Transport in the Snake and Clearwater Rivers in the vicinity of Lewiston, Idaho. USGS Open File Report 80-690.

Parkinson, S, Anderson, K., Conner, J. and Milligan, J. (2003). Sediment Transport, Supply and Stability in the Hells Canyon Reach of the Snake River, Technical Report Appendix E.1-1, Hells Canyon Complex, FERC No. 1971, Idaho Power Company, Boise, ID.

Figure 1. Relative suspended sediment loads of the Lower Granite sediment yield watershed
[i.e., Figure 151 in Appendix F]

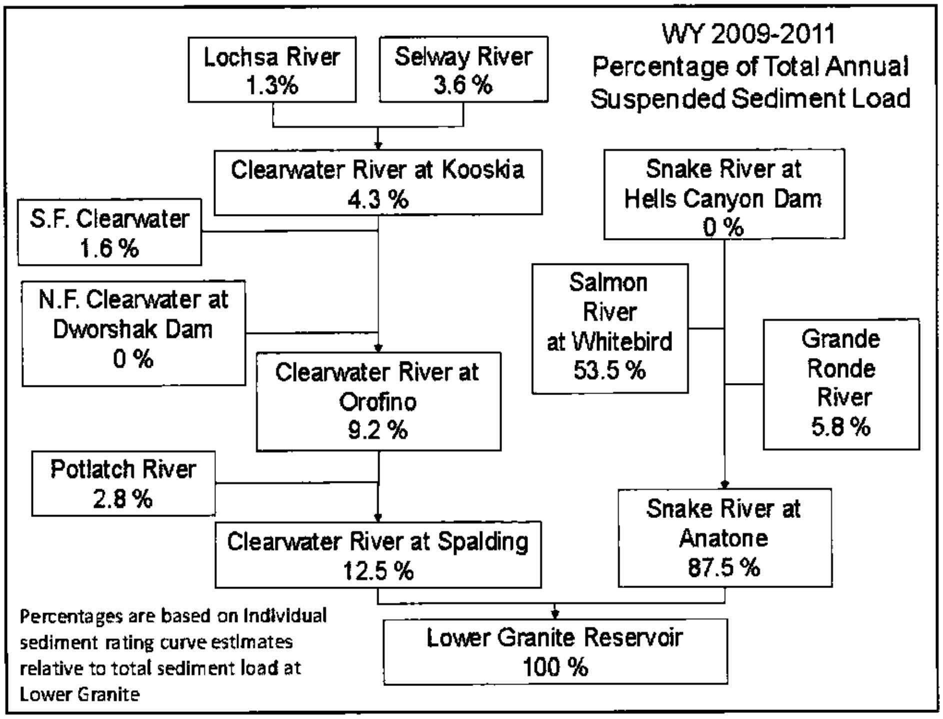


Figure 2. Relative suspended sand loads of the Lower Granite sediment yield watershed
[i.e., Figure 152 in Appendix F]

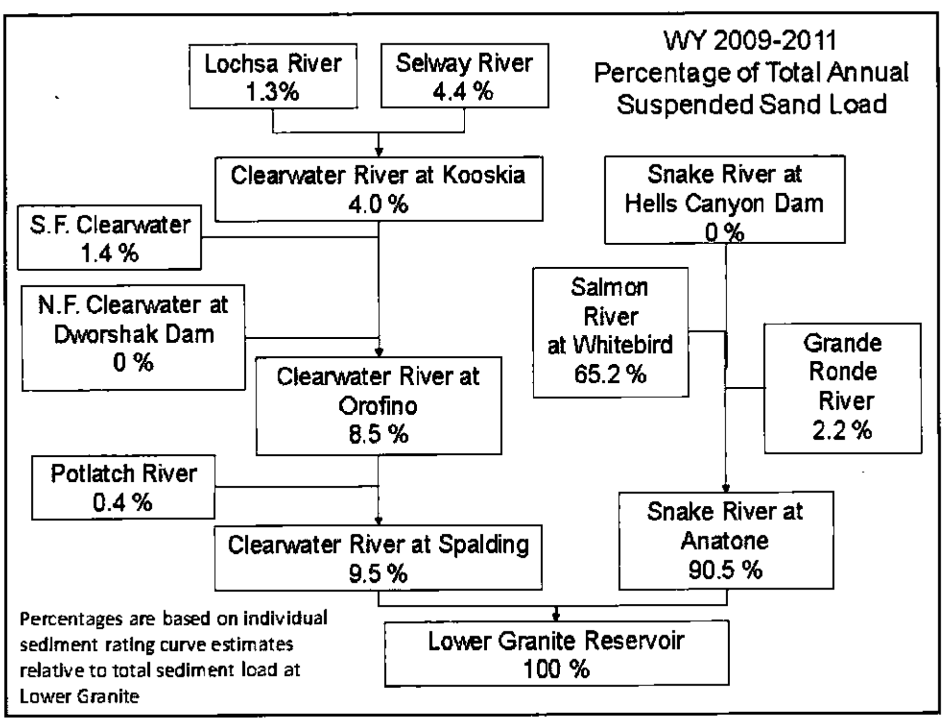


Table 1. Estimation of the percent unknown sources for suspended sediment loads of the Lower Granite sediment yield watershed.

Clearwater Basin Monitoring Location	Relative Amount[1]	'Tributary' Sum	Mainstem Difference[2]
Lochsa River	1.3%		
Selway River	3.6%	4.9%	
Clearwater River at Kooskia	4.3%		-0.6%
South Fork Clearwater River	1.6%		
North Fork Clearwater River at Dworshak Dam	0.0%	1.6%	
Clearwater River at Orofino	9.2%		3.3%
Potlatch River	2.8%	2.8%	
Clearwater River at Spalding	12.5%		0.5%
Sum Of Observed Difference in the Clearwater River			3.2%
Percent Unknown Source in the Clearwater River[3]			**26%**
Snake Basin Monitoring Location	Relative Amount	'Tributary' Sum	Mainstem Difference
Snake River at Hells Canyon Dam	0.0%		
Salmon River at Whitebird	53.5%		
Grand Ronde River	5.8%	59.3%	
Snake River at Anatone	87.5%		28.2%
Sum Of Observed Difference in the Snake River			28.2%
Percent Unknown Source in the Snake River			**32%**

[1] Values obtained from Figure 1.
[2] Calculated as the difference between measured 'Relative Amount' in the 'Tributaries' plus upstream mainstem and the observed 'Relative Amount' downstream (for example 4.3% + 1.6% + 0.0% = 5.9%, and 9.2% - 5.9% = 3.3%)
[3] Calculated as the 'Sum Of Observed Difference' divided by the downstream 'Relative Amount' (for example, 3.2%/12.5% = 26%)

Table 2. Estimation of the percent unknown sources for suspended sand loads of the Lower Granite sediment yield watershed.

Clearwater Basin Monitoring Location	Relative Amount	'Tributary' Sum	Mainstem Difference
Lochsa River	1.3%		
Selway River	4.4%	5.7%	
Clearwater River at Kooskia	4.0%		-1.7%
South Fork Clearwater River	1.4%		
North Fork Clearwater River at Dworshak Dam	0.0%	1.4%	
Clearwater River at Orofino	8.5%		3.1%
Potlatch River	0.4%	0.4%	
Clearwater River at Spalding	9.5%		0.6%
Sum Of Observed Difference in the Clearwater River			2.0%
Percent Unknown Source in the Clearwater River			**21%**
Snake Basin Monitoring Location	Relative Amount	'Tributary' Sum	Mainstem Difference
Snake River at Hells Canyon Dam	0.0%		
Salmon River at Whitebird	65.2%		
Grand Ronde River	2.2%	67.4%	
Snake River at Anatone	90.5%		23.1%
Sum Of Observed Difference in the Snake River			23.1%
Percent Unknown Source in the Snake River			**26%**

Attachment B – Forest Lands Comments

Future Increases in Sediment Loading Inferred as a 'Natural' Event

The draft EIS proposes that sediment loading from forest lands into streams within the Lower Granite Reservoir watershed will increase in the future as a result of increased frequency and intensity of forest fires in the basin. The changing forest fire regime is proposed to be a consequence of predicted future climate change, which is likely a result of human-caused increases of carbon dioxide concentrations in the atmosphere. In addition, the DEIS also notes that the fire suppression strategy implemented over the past century has resulted in forest stands that are susceptible to wildfire.

It is important to point out that one of the drivers listed above is a result of past management activities (fire suppression) and the other driver is an indirect consequence of current and past human-caused atmospheric carbon emissions,[1] both of which are a consequence of anthropogenic activities. However, it was implied in the DEIS that sediment loading from fires has no anthropogenic component because fire is a natural process and therefore there was no need for additional monitoring or management of these sediment loads. The expected sediment loading increase may be an expression of 'natural' processes, but the ultimate drivers are largely anthropogenic in origin and therefore the sediment produced by these fire events cannot be considered as not including anthropogenic influences.

Effects of Forest road 'failure' may be under-represented in the predicted future fire regimes

One of the take home messages presented throughout the DEIS is that controlling watershed sources of sediment will not affect the sediment condition at the confluence of the Snake and Clearwater Rivers. The most likely statement in the document which provides some support for this inferred conclusion in the DEIS was provided on page 25 in Appendix D, as presented below –

> *"Thus, the time-averaged effect of wildfire on sediment yields is still generally expected to be greater than the short-term effect of roads, suggesting that road restoration would provide a relatively minor reduction in sediment loads. In addition, short-term sediment yields from basins with forest roads were not substantially larger than basins without roads, further illustrating the small effect of forest roads on basin-averaged sediment yields".*

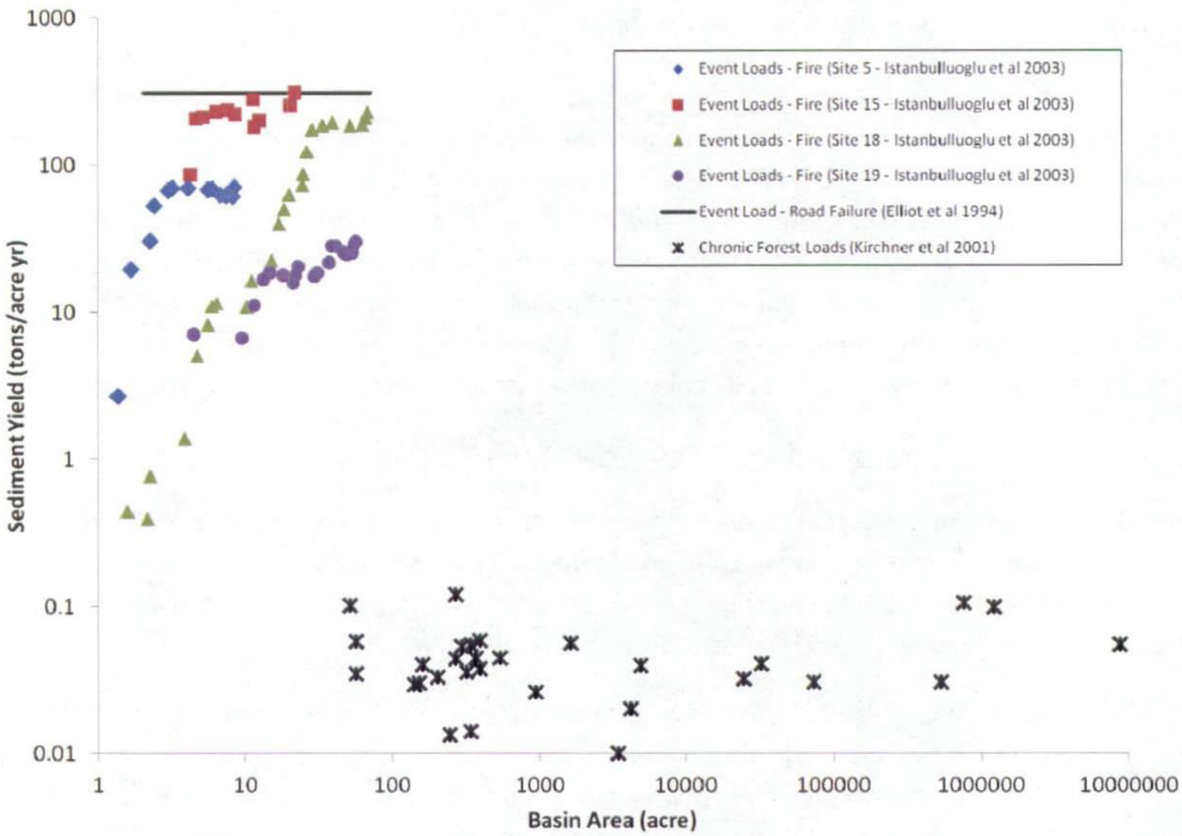
The information contained in the above listed sentences is correct; however it is incorrect to conclude that roads are not a potentially important source of sediment load. That is, it was reported in Appendix C that problems with **forest roads** can also cause very large 'mass-wasting' events, independent of the fire regime. For example, it was reported on page 10 of Appendix C that during the 1995/1996 storm event, 35% of the total estimated landslide volume in the Clearwater National Forest was from roads with 25% of the total estimated volume delivered to streams was from roads.[2] The amount of sediment

[1] See - http://www.epa.gov/climatechange/endangerment/index.html

[2] It was reported that sediment erosion following wildfires is dependent on the weather during the years following the wildfire, with potentially very high erosion resulting from gully and/or hillside "mass-failures" at high precipitation rates (Page 9 in Appendix C). It was also reported that sediment loading from **fire**-induced events tends to be at a very small spatial scale, but these very infrequent events can produce very large amounts of sediment (typically over 2 orders of magnitude larger than the long-term yields for "chronic" events), followed by long periods of relative quiescence (**Figure 1**) (Page 25 in Appendix D).

resulting from such road 'failures' can be as high or higher than 'mass-wasting' events associated with a fire alone (**Figure 1**). For example, 307 tons ac^{-1} yr^{-1} sediment yield was produced from a road 'failure' (presented as thick dark line in **Figure 1**) and sediment yield resulting from a fire was reported as 70, 310, 225, and 30 tons ac^{-1} yr^{-1} (presented in **Figure 1** as colored objects). This is an expected result because both of these 'mass-wasting' events produce similar sediment loading mechanisms (i.e., the hillslope has a landslide), and the only major difference is the initial cause of the event.

Figure 1. Reported "Event" and "Chronic" Sediment Loading Studies



Forest roads, or any other land management activity (e.g., forest harvest), may not by themselves lead to a large sediment loading event, but they could become problematic if these conditions are associated with other disturbance events (e.g., fire). For example, on closer examination of the sites associated with the fire induced 'event' sediment loads illustrated in **Figure 1** (i.e., the Istanbulluoglu et al. 2003 study), it is hard to determine if fire is the only cause of the channel scour events associated with these four sites because there are several roads located in close proximity to observed channel scour associated with these sites (**Figures 2** through **4**).[3]

[3] The authors of this study indicated that an additional 25000m^2 contributing area was added to the contributing area for one site due to the road drainage from the surrounding hillslope. It is possible that this added contributing area increased flow to the stream, which may have affected the initiation and size of the sediment production event. This site (#15) had the largest reported sediment yield in this study (**Figure 1**).

Figure 2. Trapper Creek sampling locations #18 and #15 (Istanbulluoglu et al. 2003)
[The red dot is the approximate downstream location, and yellow line is the contributing area]

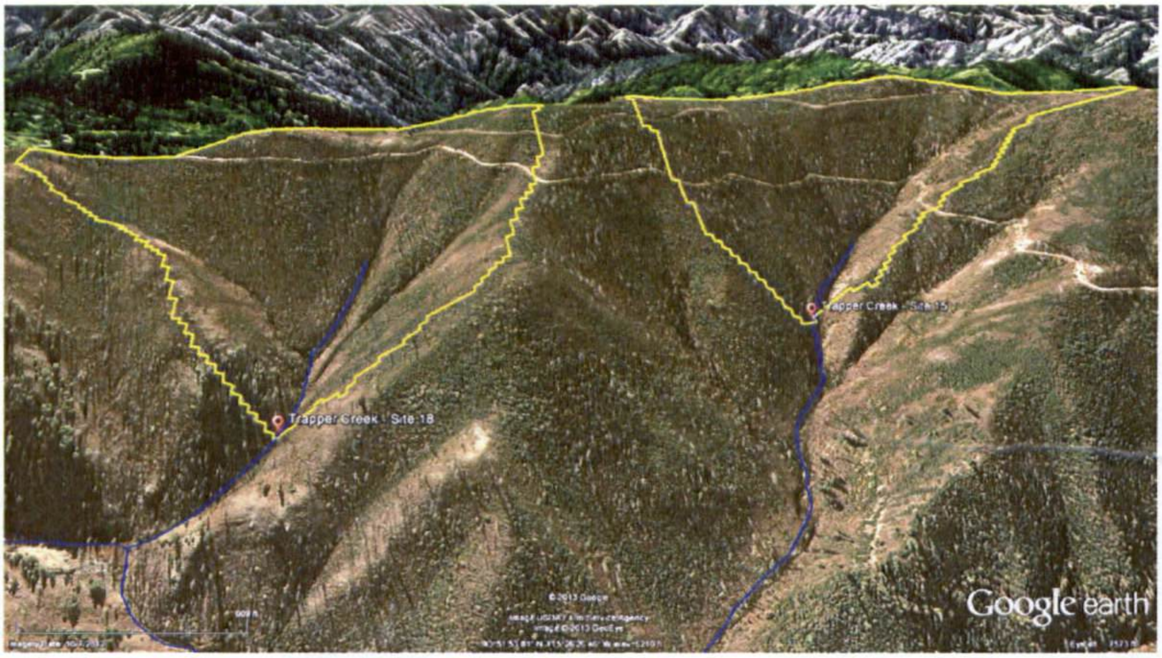
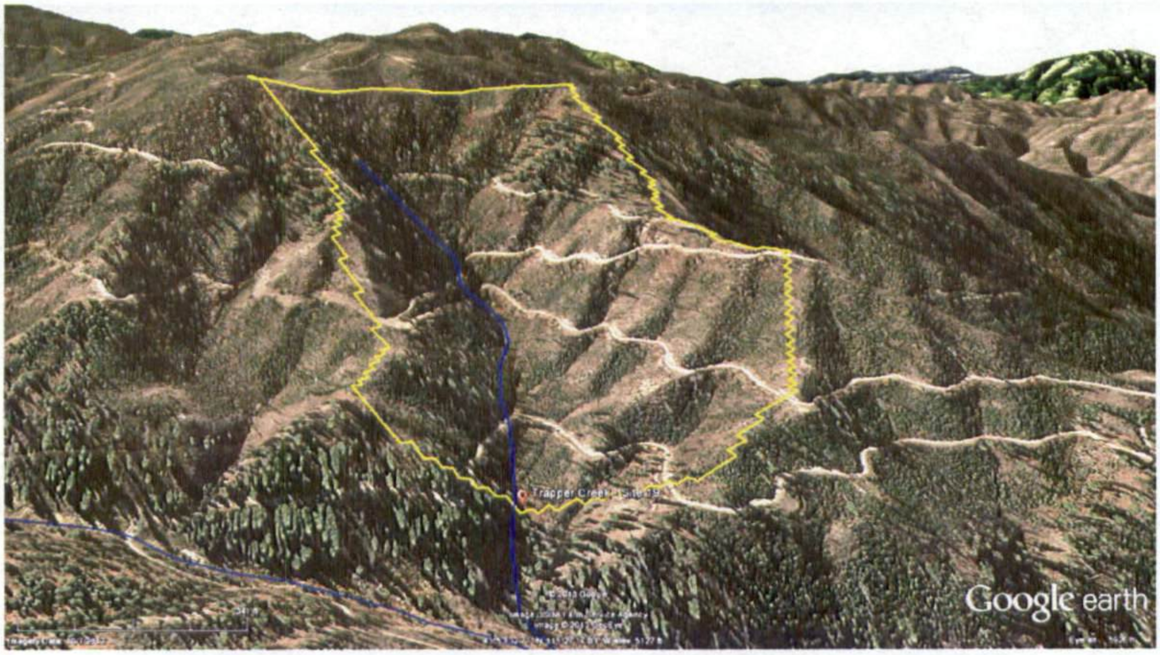


Figure 3. Trapper Creek sampling location #5 (Istanbulluoglu et al. 2003)
[The red dot is the approximate downstream location, and yellow line is the contributing area]

Figure 4. Trapper Creek sampling location #19 (Istanbulluoglu et al. 2003)
[The red dot is the approximate downstream location, and yellow line is the contributing area]



Accordingly, it is problematic to separate out any individual factor as a cause of the 'mass-wasting' event. Often a 'mass-wasting' event occurs as a result of multiple factors. For example, a 'mass-wasting' might not occur following a fire if there are no 'problematic' roads within the burn zone. It was reported in Appendix C that following a wildfire forest mangers frequently evaluate the potential for soil erosion, and risk reduction actions include mulching burned hillsides and storm-proofing of roads.

By comparison, 'mass-wasting' events associated with roads have been shown to occur without the direct influence of fire effects (Elliot et al. 1994). These road 'mass failure' events (not associated with wildfire effects) have been successfully addressed by the USFS over the past decade through road management programs, and these activities have been shown to improve water quality through reduced sediment yields.[4] However, additional steps need to be developed in order to mitigate potential future anthropogenically influenced 'mass-wasting' events as the predicted fire regime will produce hotter, larger, and more frequent fires. For example, some of these anthropogenic activities (e.g., roads) may not currently result in 'mass-wasting' events, but they may in the future with the new fire regime. As mentioned previously, the DEIS incorrectly treats fire-induced sediment loading as having no anthropogenic component, with limited management implications.

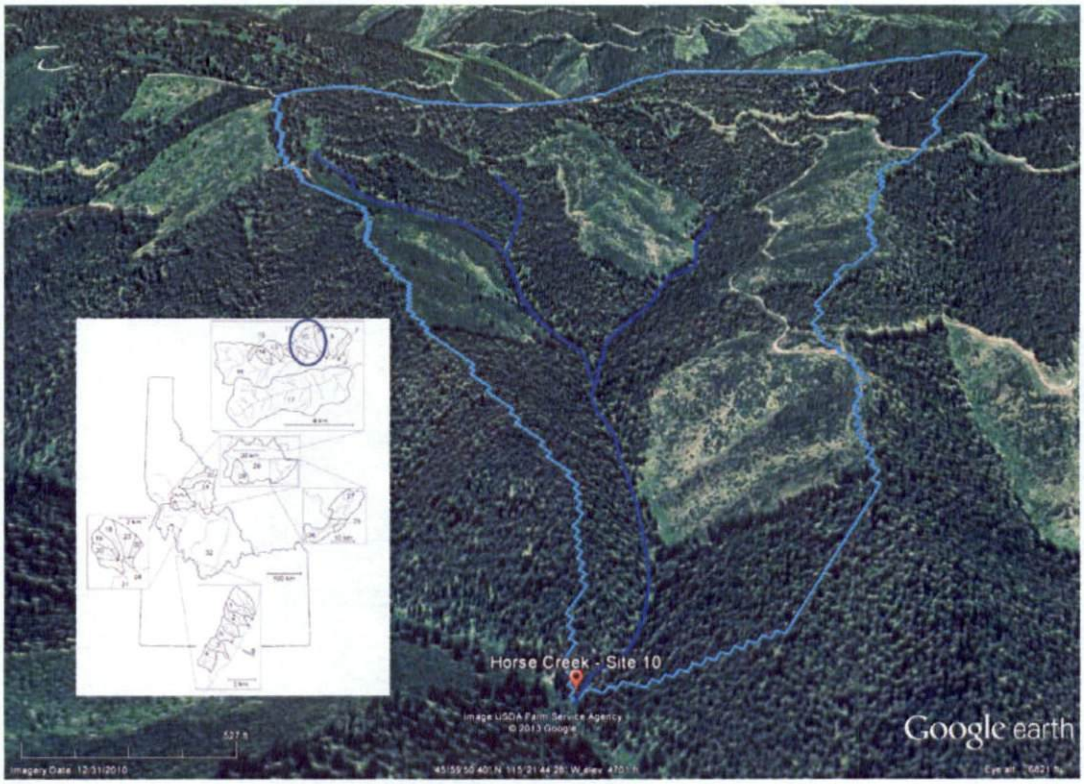
The DEIS correctly indicated that chronic loading of sediment from surfaces of forest roads is much lower than loading levels associated with 'mass-wasting' events (See black "X" marks in **Figure 1**). Accordingly, it would not be inconsistent to find that it would be difficult to observe statistically

[4]http://water.epa.gov/polwaste/nps/success319/ Click on "Idaho" and select "Tepee", "Steamboat" and "Yellowdog" examples.

significant differences in sediment loading when comparing forested watersheds with roads and forested watersheds without roads when there were no reported 'mass-wasting' events within the basins. (The authors of Appendix D indicated that both types of watersheds were associated with the Kirchner et al. (2001) sites reported in **Figure 1** in this attachment.)

Presented below is an image of one of these watersheds which might be considered as "roaded" within the Kirchner et al. 2001 study (**Figure 5**).[5] Three things can be seen in this image. First, the distance between forest roads and the sampling location is relatively far and, in addition, the roads are not located near the stream channel (indicated by the blue lines), which can reduce the potential sediment loading to a stream. There may be other watershed land management characteristics which would have produced completely different results (e.g., roads located near the stream channel, and the roads are located on steep slopes, and the roads are in some sort of disrepair). Accordingly, there may situations when sediment loading from chronic sources (e.g., roads or clearcut harvest) will be measurable in the water column and stream bed material. Second, there are other potential sediment sources within the basin (e.g., forest harvest) which makes it difficult to separate out the effects of any of the potential sediment sources. Finally, although it is very hard to determine from the photo, it does not appear that there are any 'mass-wasting' events associated with either the roads or harvest activities within this basin.

Figure 5. Horse Creek sampling location #10 (Kirchner et al. 2001)
[The red dot is the approximate downstream sampling location, and teal line is the contributing area]



[5] Visual inspection of the other "roaded" watersheds associated in this study indicates that this site is representative of the other sites.

Reference Cited

Elliot, W., T Koler, J. Cloyd, and M. Philbin. 1994. Impacts of Landslides on an ecosystem. Written for Presentation at the 1994 ASAE International Winter Meeting.

Istanbulluoglu E., D. Tarboton, R. Pack, and C. Luce. 2003. A sediment transport model for incision of gullies on steep topography. Water Resources Research 39, 1103.

Krichner J., R. Finkel, C. Riebe, D. Granger, J. Clayton, J. King, and W. Megahan. 2001. Mountain erosion over 10yr., 10k.y., and m.y. time scales. Geology 29, 591-594.

Attachment C - Agriculture Lands Comments

Potential under-prediction of Sediment Loads from Agriculture Areas as reported in Appendix E

Appendix E presented **modeled** sediment yields from agricultural lands associated with the project area. This analysis was a two step modeling process: 1) sediment erosion on agriculture lands was estimated using the RUSLE2 model, and 2) estimated erosion rates were then modified by Sediment Delivery Ratios (SDR) in order to estimate the amount of sediment that would reach the bottom of the assessment unit (i.e., the stream at the bottom of each watershed assessment unit).

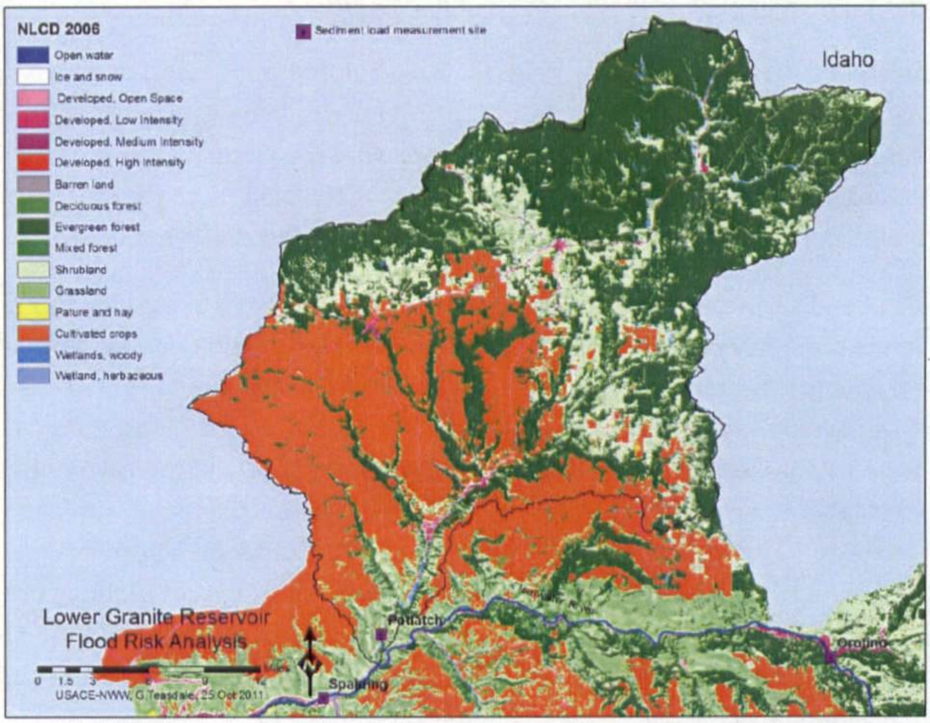
Alternatively, Appendix F presented sediment yields **calculated from field data** for several tributaries located within the project area (**Table 1**). This analysis utilized regression relationships derived from measured field data (see Section 9.16.4 in Appendix F). Of particular note in **Table 1** were the results for the Potlatch River, which had one of the highest sediment yields (i.e., 0.25 tons/ac/yr). Once again, these yields were estimated from measured instream sediment data, and therefore the results presented in this table incorporated all sediment routing/deposition (i.e., SDR) within the stream network. These results also included sediment loading from the different landcover conditions within the basin. Agriculture lands cover 30% of the Potlatch watershed with most of this activity located near the mouth of the basin, and forest landcover is in the upper watershed (**Figure 1**). The proportional sediment yield (tons/ac/yr) from **agricultural areas** in the Potlatch Basin can be estimated from the information presented above.

Table 1. Reported Mass Balance and watershed sediment yield for Lower Granite Reservoir (2009-2011) [i.e., Table 76 in Appendix F]

Total Suspended Sediment Mass Balance Water Years 2009-2011							
Source Watershed	Suspended Sediment tons	Watershed Area mi2	Sediment Yield ton/mi^2/yr	Sediment Yield ton/ac/yr	Percent of Spalding	Percent of Anatone	Percent of Lower Granite
Selway River	359,154	1,916	62.5	0.10	28.4%		3.6%
Lochsa River	132,258	1,178	37.4	0.06	10.5%		1.3%
Lower Middle Fork (computed)[1]	-58,786	313	-62.6	-0.10	-4.7%		-0.6%
S.F. Clearwater above Harpster	152,876	878	58.0	0.09	12.1%		1.5%
Lower S.F. Clearwater (computed)[2]	16,862	291	19.3	0.03	1.3%		0.2%
Above Orofino (computed)[3]	330,043	931	118.1	0.18	26.1%		3.3%
Potlatch River	285,316	594	160.2	0.25	22.6%		2.8%
Lower Clearwater (computed)[4]	44,940	738	20.3	0.03	3.6%		0.4%
Total at Spalding	1,262,662	6,839	61.5	0.10	100.0%		12.5%
Salmon River at Whitebird	5,406,912	13,424	134.3	0.21		61.1%	53.5%
Grande Ronde River at mouth	589,980	4,101	48.0	0.07		6.7%	5.8%
Lower Snake River (computed)[5]	2,851,571	2,108	451.0	0.70		32.2%	28.2%
Total at Anatone	8,848,463	19,633	150.2	0.23		100.0%	87.5%
Total at Lower Granite	10,111,125	27,137	124.2	0.19			100.0%

[1] Kooskia - (Selway + Lochsa)
[2] Stites - Harpster
[3] Orofino - (Kooskia + Stites)
[4] Spalding - (Orofino + Potlatch)
[5] Anatone - (Whitebird + Grande Ronde)
[6] Anatone + Spalding

Figure 1. 2006 NLCD grid for the Potlatch River Basin
[Figure 159 in Appendix F]



The reported sediment yield for the Potlatch Basin (i.e., 0.25 tons/ac/yr) is a function of loads from both agricultural lands and forested lands within the Potlatch watershed. Sediment yield for non-agriculture areas were assumed to equal the average **measured** condition reported for 30 forested Idaho basins (i.e., 0.05 ton/ac/yr)(Krichner et al., 2001). Accordingly, the proportional "sediment yield from agricultural lands" in the Potlatch Basin can be estimated using the following equation:

$$\begin{aligned}&\mathit{Total\ Sediment\ Yield}\\&\quad = (\mathit{Nonagricultural\ Land\ Sediment\ Yield}) * (\mathit{Percent\ Nonagriculture\ area})\\&\quad + (\boldsymbol{Agricultural\ Land\ Sediment\ Yield}) * (\mathit{Percent\ Agriculture\ area})\end{aligned}$$

Or

$$\begin{aligned}&0.25\ tons/ac/yr\\&\quad = (0.05\ tons/ac/yr) * (0.70) + (\boldsymbol{Agricultural\ Land\ Sediment\ Yield}) * (0.30)\end{aligned}$$

Solving for "Agricultural Land Sediment Yield" results in a sediment yield of **0.72** tons/ac/yr. It is important to note that this measured loading rate is much higher than the **modeled** sediment yields for agriculture areas that were reported in Appendix E, a weighted average sediment yield of **0.13** tons/ac/yr (**Table 2**).

Table 2. Estimated Weighted Average Sediment Yield from Agriculture Areas reported in Appendix E						
Basin	Mean Erosion (tons/ac/yr)[1]	SDR[2]	Sediment Yield (tons/ac/yr)[3]	Agricultural Area (mi^2)[4]	Proportion Ag Area of Total Ag Area[5]	Weighted Average Sediment Yield (tons/ac/yr)[6]
Palouse	3.3	0.041	0.14	1029.74	0.3323	0.0450
Clearwater	4.1	0.041	0.17	593.66	0.1916	0.0322
Lower Snake-Tucannon	3.4	0.045	0.15	417.85	0.1348	0.0206
Rock	2.5	0.049	0.12	518.61	0.1674	0.0205
South Fork Clearwater	2.8	0.047	0.13	122.10	0.0394	0.0052
Lower Snake	1.9	0.052	0.10	165.15	0.0533	0.0053
Lower Snake-Asotin	1.9	0.052	0.10	82.00	0.0265	0.0026
Lower Salmon	2.2	0.046	0.10	36.96	0.0119	0.0012
Upper Grande Ronde	0.8	0.044	0.04	99.80	0.0322	0.0011
Wallowa	1.3	0.049	0.06	20.57	0.0066	0.0004
Lower Grande Ronde	2.2	0.044	0.10	10.54	0.0034	0.0003
Little Salmon	12.4	0.055	0.68	0.59	0.0002	0.0001
Middle Fork Clearwater	4.7	0.075	0.35	0.61	0.0002	0.0001
Hells Canyon	7.5	0.057	0.43	0.53	0.0002	0.0001
Sum of Weighted Average Sediment Yield from agriculture areas						**0.13**

[1] Obtained from Table 9 in Appendix E and values were estimated using the RUSLE2 model
[2] Obtained from Table 10 in Appendix E
[3] Calculated as SDR * Average Erosion
[4] Estimated from Table 9 in Appendix E
[5] Estimated as the agriculture area divided by the total agricultural area for all of the basins
[6] Estimated as SDR Modified Erosion * Proportion Ag Area of Total Ag Area

There are several potential reasons for the apparently low sediment yields **modeled** for agricultural areas, including: 1) issues with sediment erosion calculations using the RUSLE2 model; 2) issues with Sediment Delivery Ratio (SDR) used in the analysis; and/or 3) not accounting for potential sediment sources within agriculture areas. It is very difficult to evaluate the effect these factors, or any other factor, has on modeled sediment yield results presented in Appendix E. However, the brief discussion below presents some analysis on this topic.

RUSLE2 Modeling

Estimated erosion rates using the RUSLE2 model in Appendix E were not significantly different than other RUSLE2 modeling results previously reported for Potlatch sub-basins (Barber and Mahler, 2010) (**Table 3**). That is, reported mean surface erosion rates in **Table 2** and **Table 3** are similar. Accordingly, it appears that the RUSLE2 modeling surface erosion results reported in Appendix E are within the range of expected values. Therefore, the low sediment yields reported in Appendix E and listed in Table 2 are not likely a result of the RUSLE2 modeling effort.

Table 3. Estimate of Mean surface erosion in the lower Potlatch basin (Barber and Mahler 2010)

Basin	Mean Surface Erosion calculated using RUSLE2 (tons/ac/yr)
Big Bear	3.57
Cedar	2.33
Little Bear	2.87
Little Potlatch	6.85
Middle Potlatch	5.18
Pine	4.23

Sediment Delivery Ratio (SDR)

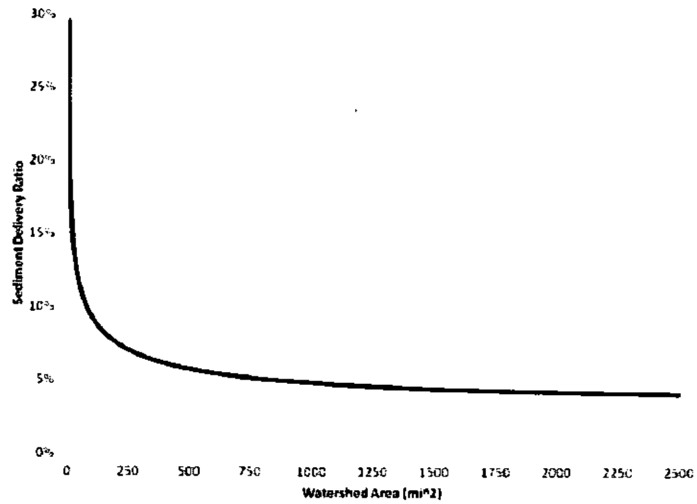
As reported in Appendix E, modeled surface erosion rates on the agricultural lands were routed through the stream network by use of a SDR. The SDR was intended to account for deposition and storage of sediment between the hillslope and watershed outlet. Specifically, the SDR developed by Vanoni (1975) was used in Appendix E:

$$SDR = 0.003567[In(A_{ws}))]^2 - 0.060465[In(A_{ws})] + 0.295745$$

where A_{ws} is the watershed area in square miles. They reported in Appendix E that this relationship was based on watersheds ranging in size from 1 square mile to 300 square miles. The watershed areas associated with the assessment units associated with the DEIS are much larger than this size range (**Table 4**). Based on the SDR equation listed above, the amount of surface erosion that reaches the bottom of the watershed ranges from 30% for a very small watershed, to around 4% for very large watersheds (**Figure 2**). It is important to point out that watershed size has the greatest influence on sediment delivery at size ranges less than 300 square mile, with very little change at larger watershed size conditions. Accordingly, SDR ratios for the watershed evaluated in the DEIS mostly ranged from 4 to 5% (**Table 2**).

Table 4. Watershed Areas reported in Table 9 in Appendix E	
Name	Area (mi^2)
Palouse	2351
Clearwater	2319
Lower Snake-Tucannon	1461
Rock	973
South Fork Clearwater	1174
Lower Snake	734
Lower Snake-Asotin	713
Lower Salmon	1232
Upper Grande Ronde	1636
Wallowa	935
Lower Grande Ronde	1506
Little Salmon	589
Middle Fork Clearwater	204
Hells Canyon	532

Figure 2. Sediment Delivery Ratios for various watershed sizes, based on Vanoni (1975).



SDR values developed in Appendix E were derived for the entire watershed area, while agricultural land use comprises only a fraction of the watershed area. Accordingly, it appears that the calculated SDR used in the original analysis were overestimated. As mentioned previously, SDR values were used to estimate the amount of the RUSLE2 derived sediment that would reach a downstream watershed location. SDR should be calculated by area of agricultural use, and not the entire watershed area. It is important to point out that agricultural areas are often located in lower portions of the watershed, near water sources and tend to be located on flat land areas, while forested areas are generally located in upper watershed areas (see Figure159 from Appendix F and presented above). Accordingly, including the upslope forest areas during SDR calculations dilutes the potential delivery of sediment from agriculture lands (i.e., doing so assumes that the upslope forested areas have an effect on the agricultural load near the watershed mouth). Using the modified SDR values, estimated sediment yield from agricultural areas increased from 0.13 to 0.18 ton/ac/yr (**Table 5**).

Table 5. Estimated Weighted Average Sediment Yield from Agriculture Areas using a modified SDR [Italicized values indicated changes from values presented in Table 2]						
Basin	Mean Erosion (tons/ac/yr)[7]	***Modified*** *SDR*[8]	***Modified*** *Sediment Yield (tons/ac/yr)*[9]	Agricultural Area (mi^2)[10]	Proportion Ag Area of Total Ag Area[11]	*Weighted Average* ***Modified*** *Sediment Yield (tons/ac/yr)*[12]
Palouse	3.3	*0.048*	*0.16*	1029.74	0.3323	*0.0526*
Clearwater	4.1	*0.055*	*0.23*	593.66	0.1916	*0.0433*
Lower Snake-Tucannon	3.4	*0.061*	*0.21*	417.85	0.1348	*0.0279*
Rock	2.5	*0.057*	*0.14*	518.61	0.1674	*0.0239*
South Fork Clearwater	2.8	*0.088*	*0.25*	122.10	0.0394	*0.0097*
Lower Snake	1.9	*0.080*	*0.15*	165.15	0.0533	*0.0081*
Lower Snake-Asotin	1.9	*0.099*	*0.19*	82.00	0.0265	*0.0050*
Lower Salmon	2.2	*0.124*	*0.27*	36.96	0.0119	*0.0033*
Upper Grande Ronde	0.8	*0.093*	*0.07*	99.80	0.0322	*0.0024*
Wallowa	1.3	*0.146*	*0.19*	20.57	0.0066	*0.0013*
Lower Grande Ronde	2.2	*0.173*	*0.38*	10.54	0.0034	*0.0013*
Little Salmon	12.4	*0.329*	*4.08*	0.59	0.0002	*0.0008*
Middle Fork Clearwater	4.7	*0.326*	*1.53*	0.61	0.0002	*0.0003*
Hells Canyon	7.5	*0.335*	*2.51*	0.53	0.0002	*0.0004*
Sum of Weighted Average Sediment Yield from agriculture areas						***0.18***

[7] Obtained from Table 9 in Appendix E and values were estimated using the RUSLE2 model
[8] Modified SDR was derived using agricultural area with the Vanoni (1975) equation.
[9] Calculated as SDR * Average Erosion
[10] Estimated from Table 9 in Appendix E
[11] Estimated as the agriculture area divided by the total agricultural area for all of the basins
[12] Estimated as SDR Modified Erosion * Proportion Ag Area of Total Ag Area

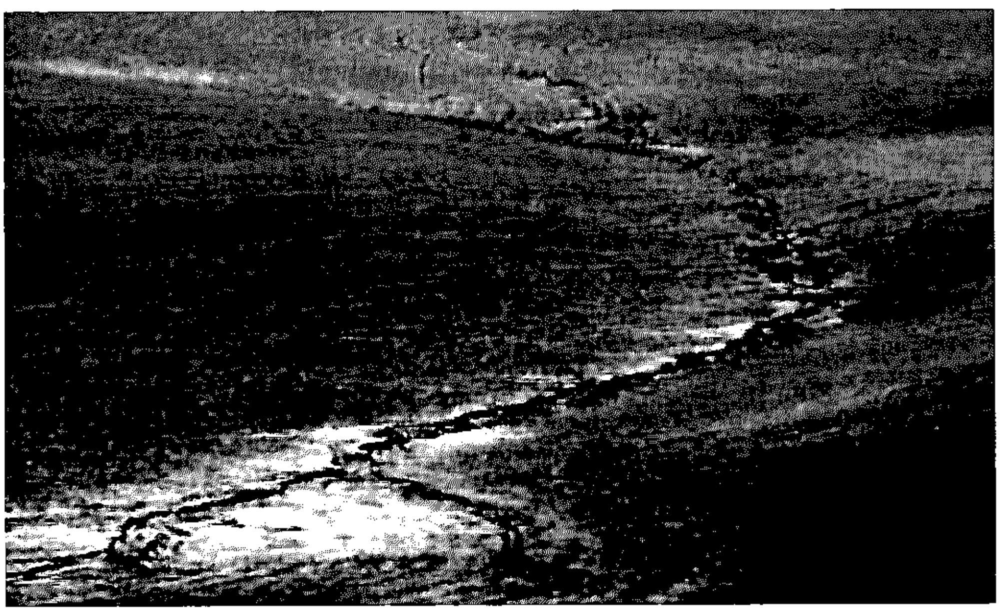
Not accounting for potential sediment sources on agriculture areas

RUSLE2 modeling only evaluates the sheet and rill component of sediment erosion, and does not evaluate other potential sources of sediment erosion. One such potential sediment source are ephemeral gullies. The RUSLE2 model does **not** evaluate the impact that ephemeral gullies have on sediment production. Ephemeral gullies have been shown to be an important source of sediment production in agricultural areas within the project area. Ephemeral gullies also provide a temporary route for sediment to reach a waterway:

"[RUSLE2 does not] specifically address ephemeral gullies. Ephemeral gullies are channelized flow areas formed downslope of rills or rill networks in locations controlled primarily by microrelief expressed by tillage and are small enough to be repeatedly obliterated by normal tillage operations. In addition to the volume of soil eroded from the gullies, ephemeral gullies act as delivery channels for surface erosion."

(Barber and Mahler, 2010)

Example Image of regional ephemeral gully erosion (Figure 3 in Appendix E)



Not all ephemeral gullies will provide direct delivery of sediment to the stream network; however it is possible that many gullies will provide extra sediment to the stream network. During large rain events which produce these ephemeral gullies, the stream network length increases as ephemeral streams are created within areas previously without surface flows. Following such a large storm event, which creates both ephemeral streams and ephemeral gullies, the water dries up and only the gullies remain. If these events produce sediment that reach the intermittent and/or perennial stream network, then sediment produced during this event will be routed downstream overtime. The routing of sediment is much more efficient within the flowing stream network. Accordingly, it could be expected that more of the sediment produced during these gully erosion events will reach the downstream location of the watershed if the sediment is routed within the fluvial stream network.

Barber and Mahler (2010) reported observing 1004 ephemeral gullies in agricultural areas in the lower Potlatch basin. It is important to note that they only evaluated 62% of the agricultural areas of the lower Potlatch basin. Assuming that the ephemeral gullies are evenly distributed throughout agricultural areas in the basin, this corresponds to 2235 ephemeral gullies for agriculture lands within the Potlatch Basin. In summary, approximately 85.2 mi^2 of agricultural land is located within the Potlatch basin, with approximately 2235 ephemeral gullies. This corresponds to 26.2 ephemeral gullies per square mile of agriculture land in the Potlatch watershed.

Extrapolating ephemeral gully production observed within the Potlatch basin (i.e., 26.2 ephemeral gullies per square mile of agriculture land) to all of the agricultural areas within the project watershed area (i.e., 284 mi^2) results an estimated 81,276 ephemeral gullies produced per year when there are widespread, large rain events. Obviously, this is a very rough estimate, but this value does indicate that many ephemeral gullies can be produced within the project watershed area. It is possible that a small fraction of these gullies will produce sediment that is routed through the system, which may in turn, influence the sediment budget at the confluence of the Snake and Clearwater Rivers.

In addition, it is possible the sediment sources associated with these ephemeral gullies could be responsible for some of the observed discrepancy in sediment yield reported in Appendix E (**Table 2**), and Appendix F (**Table 1**).

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Barber M., and R. Mahler. 2010. Ephemeral gully erosion from agricultural region in the Pacific Northwest., USA. Annals of Warsaw University of Life Sciences, Land Reclamation No 42 (1), 23-29.

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Vanoni, V.A. 1975. Sedimentation Engineering, American Society of Civil Engineers. 745p